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was occupied by a lake which has left terraces about the valley. These are finely preserved on the slope west of the north end of the valley.

*Economic geology.*—As economic features there are represented on the map numerous lenses of limestone, which is often highly magnesian. Gold quartz veins are indicated by orange dashes. The auriferous gravels are noted, and also deposits of chrome iron and of magnetite.

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*Bulletin of the American Museum of Natural History.* Vol. IX, 1897.

This volume contains twenty-four separate articles contributed by members of the museum staff. Those from the departments of vertebrate and invertebrate palæontology will be briefly noticed.

Article IV. *Note on the Hypostome of Lichas (Terataspis) grandis* Hall. By R. P. WHITFIELD, pp. 45-46.

*Lichas (Terataspis) grandis*, is one of the largest and most highly ornamented trilobites of the Devonian faunas. As yet it has never been found preserved except as fragments, and previous to the present paper no hypostome of the species has been described. This note by Professor Whitfield describes, with illustrations, two large hypostomes supposed by him to belong to this species. They are from loose boulders of Schoharie grit obtained in northern New Jersey and are associated with other fragments of the same trilobite and with other species of the same horizon.

Article VI. *The Ganodonta and their relationship to the Edentata.* By J. L. WORTMAN, pp. 59-110.

The relationship of the Edentate mammals has long puzzled zoölogists, and previous to the establishment of the suborder *Ganodonta* by Dr. Wortman, no palæontologist has more than suggested what this relationship might be. Although the genera composing the group have long been known, yet the materials, up to the present time, have been so imperfect and fragmentary as to preclude any very exact knowledge of their affinities, and they have been placed by different authors at different times with the *Tillodontia*, the *Tæniodonta*, and the *Creodontia*. By the aid of the discovery of a fore limb of one of the species, *Pisittacotherium multifragum*, in association with the lower jaw and

upper teeth, Dr. Wortman has been enabled to interpret the somewhat fragmentary remains of the other genera and to make out what he believes to be, not only their affinities to each other, but what is still more important, to demonstrate their genetic relationship to the later appearing American *Edentata*.

The genera included in the suborder are *Conoryctes*, *Onychodectes*, *Hemiganus*, *Pisittacotherium*, *Calamodon*, and *Stylinodon*. In the treatment of the relationship of these genera to the *Edentata*, seventeen points of resemblance are enumerated, and they are considered as a primitive suborder of and the ancestors of the Edentates.

The South American Edentates appear suddenly in the Santa Cruz formation in great numbers and variety with apparently no previous announcement in the older deposits. This fact would seem to indicate that they were immigrants from another region. While the Santa Cruz beds cannot yet be accurately placed in the time scale, it is highly probable that they are not older than the North American Oligocene. In North America the *Ganodonta* appear in the very earliest Puerco deposits and continue without interruption into the Bridger, where they disappear.

If Dr. Wortman's conclusions as to the relationship of the *Ganodonta* to the *Edentata* be correct, as they seem to be, the geographic distribution of the groups would suggest that during Eocene time there was at least a temporary connection between the North and South American continents, allowing the immigration from the north, of the ancestors of the South American Edentate fauna.

Article XI. *Description of New Species of Silurian Fossils from near Fort Cassin and elsewhere on Lake Champlain.* By R. P. WHITFIELD, pp. 177-184. Plates IV-V.

The fauna of the Fort Cassin beds on Lake Champlain is one of remarkable interest. Its position is in the Lower Ordovician, in the upper part of the Calciferous formation. As a rule the Calciferous strata do not furnish an abundance of fossils, either specifically or individually, but the Fort Cassin beds are an exception. Two previous papers containing descriptions of species from this bed by Professor Whitfield<sup>1</sup> have appeared, so that in all 60 species are now known, distributed as follows, 25 gastropoda, 17 cephalopoda, 8 trilobites, 7 brachiopoda, 2 crustacea (not trilobites) and 1 bryozoan.

<sup>1</sup> Bull. Am. Mus. Nat. Hist., I, p. 293, and Bull. Am. Mus. Nat. Hist., III, p. 25.

Article XII. *Descriptions of species of Rudistæ from the Cretaceous Rocks of Jamaica, W. I., Collected and Presented by Mr. F. C. Nicholas.* By R. P. WHITFIELD, pp. 185-196. Plates VI-XXII.

This papers contains descriptions with excellent illustrations of ten new species of these interesting fossils from Jamaica. Six species are referred to the genus *Radiolites*, and four to *Caprina*.

Article XX. *Observations on the Genus Barrettia Woodward, with Descriptions of New Species.* By R. P. WHITFIELD, pp. 233-246. Plates XXVII-XXXIII.

The genus *Barrettia* was established by Woodward, upon some peculiar cup-shaped fossils from the Cretaceous limestone of Jamaica, W. I., and was referred by him to the *Rudistæ*. Since the original description several authors have expressed doubts as to the correct reference of the genus to this group, and have questioned its molluscan nature, considering it to be more probably a coral.

Professor Whitfield's investigation of the genus is based upon a collection of these fossils, some of them of large size, sent to the museum by Mr. F. C. Nicholas. All of the characters, some of which were not observed by Woodward, are carefully summed up and the conclusion is reached that they are most probably corals. The paper is concluded by the description of two new species.

Article XXI. *The Huerfano Lake Basin, Southern Colorado, and its Wind River and Bridger Fauna.* By H. F. OSBORN, pp. 247-258.

The presence of Eocene beds in the Huerfano River basin of southern Colorado, was first made known, in 1888, by Professor R. C. Hills, of Denver. Three papers, published between 1888 and 1891, record the results of his observations upon the region. In the course of his investigation, the Huerfano series was divided into three divisions, beginning from the top as follows, (1) Huerfano beds 3300 feet, (2) Cuchara beds, 300 feet, and (3) Poison Canyon beds 3500 feet. The Huerfano beds were correlated with the Bridger group or Middle Eocene, on the basis if the vertebrate remains discovered, and the two lower divisions were provisionally referred to the lower Eocene from their stratigraphic position, no fossils being found.

At a later date the region was visited by Professor Osborn and Dr. Wortman, and the present paper records the results of their observations.

The two lower divisions, the Cuchara and Poison Canyon beds, were found to lie unconformably below the Huerfano beds, and from the presence of a species of *Baculites* it is supposed that they are Cretaceous deposits of marine origin. These Cretaceous beds were found to be certainly not 800 feet below the summit of the upper Huerfano beds, so that the observation affects not only the determination of the age of the Poison Canyon and Cuchara beds, but materially reduces the thickness of the upper beds.

The only true Huerfano lake deposits are variegated marls, clays, soft shales and sands, aggregating only 800 to 1000 feet in thickness, and lying in a nearly horizontal position. In these beds, although without doubt forming a continuous deposition, two distinct horizons were identified from their inclosed vertebrate remains. The upper one of these horizons, the one from which Professor Hills secured the major part of his material, is of Bridger age. The lower horizon, however, contains none of the forms characteristic of the Bridger level, but is distinguished as of Wind River or of Wasatch age, by the presence of several characteristic lower Eocene forms.

Article XXII. *A Revision of the Puerco Fauna.* By W. D. MATTHEW. Pp. 259-323.

The Puerco fauna was first described by Cope in numerous papers published between 1881 and 1888. Ninety-one species of mammals were recognized, and to these three more were added by Osborn and Earle in 1895. The original collections used by Cope are now the property of the museum, and to these have been added important collections made by the museum expeditions in charge of Dr. J. L. Wortman. The present revision is based upon all of these collections, and consists largely in a rearrangement of the species and a reduction of their number, made possible by the more perfect material.

The fauna of the upper Puerco beds is found to be entirely distinct from that of the lower beds, not a single species being common to both, and in no case does a genus pass through without serious modification of at least subgeneric value. Because of this difference in the faunas, Dr. Wortman proposes to designate the upper beds by the name Torrejon formation.

The Puerco-Torrejon faunas are composed of the following elements:

1. The Mesozoic group of Multituberculates culminates in the

Puerco and dies out in the Torrejon, true Rodents coming in to take its place.

2. The main body of the fauna is composed of primitive types from which sprang the Ungulates on the one hand and the later Creodonts and Carnivores on the other. In the Puerco these two divisions are hardly distinguishable, but in the Torrejon they are clearly separable, although still closely allied.

3. A few more specialized lines, the Edentata, Amblypoda and Rodents, with a fourth type allied to the Primates, may be separated from the main group.

A total number of seventy-five species is recognized in the whole fauna.

STUART WELLER.